PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G04G 1/00, 9/00 | A1

(11) International Publication Number: **WO 99/38053**

(43) International Publication Date: 29 July 1999 (29.07.99)

(21) International Application Number: PCT/GB99/00213

(22) International Filing Date: 21 January 1999 (21.01.99)

(30) Priority Data:
9801503.5 24 January 1998 (24.01.98) GB

(71) Applicant *(for all designated States except US)*: UNIVERSAL TIME LTD. [GB/GB]; 44 Friar Lane, Nottingham NG1 6DQ (GB).

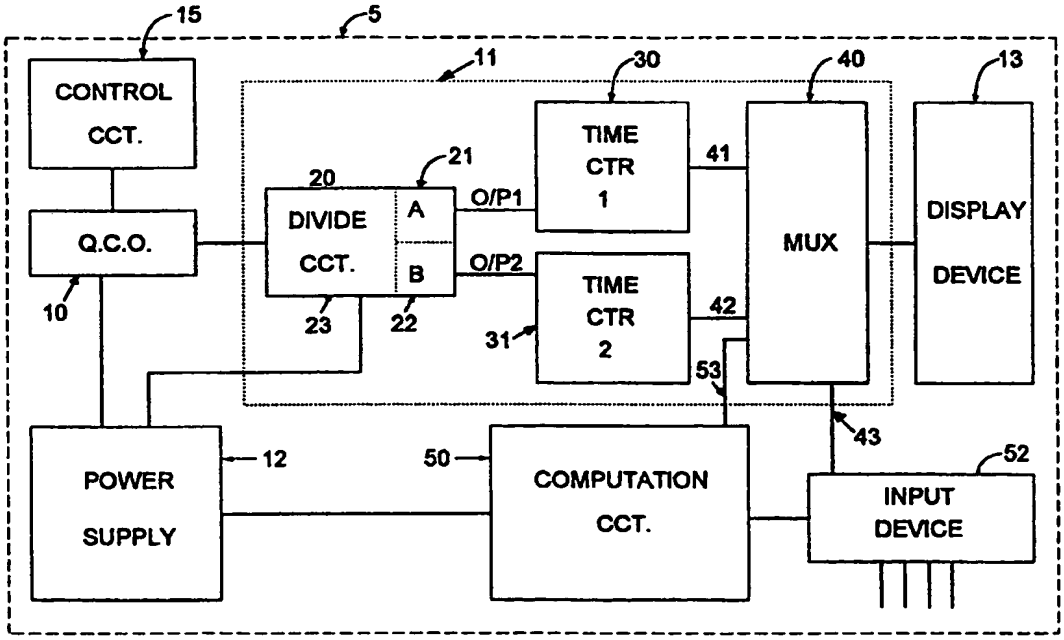
(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: GEARY, Paul, Francis [GB/GB]; 2 Friar's Walk, Newton Garden Village, Newton, Notts NG13 8HE (GB).

(74) Agent: CHARIG, Raymond; Eric Potter Clarkson, Park View House, 58 The Ropewalk, Nottingham NG1 5DD (GB).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: TIME MEASUREMENT DEVICE



(57) Abstract

A chronometer for maintaining and displaying time in two different modes, i.e. in a first time base and co–ordinate system such as hours, minutes and seconds on a Gregorian–type system and a corresponding time in a second time base such as a universal co–ordinate, metric time base system. The chronometer can include a converter for converting a predetermined time input by the user in one time base to the other time base for display.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

TIME MEASUREMENT DEVICE

The present invention relates to time measurement devices, and in particular to personal chronometers such as watches and clocks. Throughout the present specification, the expression "chronometer" will be used to include all forms of time-keeping devices for maintaining a track of a current time relative to an origin (eg. when the chronometer is set or started) and for providing an output of that current time, eg. by visual display or machine readable output.

With the advent of widespread international travel and of mass communication systems such as the Internet, confusion over differing time zones around the world causes an increasing number of problems. For example, when scheduling teleconferencing or video-conferencing facilities and the parties involved therein, the exact time in each time zone (including the effect of any local daylight saving time) must be known. Also, where distributed transactions or events are carried out in several different countries and parts of the transaction must be carried out in strict chronological sequence, it is essential that there is no confusion over the "absolute" time.

A known solution to this problem is to provide a chronometer, or series of chronometers running in parallel to display the time at more than one "time zone". Modern digital watches already provide "world time" functions to display the time in any of the internationally recognised time zones. Such watches merely add or subtract a predetermined number of hours from a base line or home time zone.

This solution is not ideal, because it does not necessarily take into account local times or local daylight saving times as they vary around the world, without additional knowledge from the user. It also still leaves room for error in a user misunderstanding which time zone a predetermined schedule is provided in, or providing an incorrect base line by confusion with their own time zone.

Therefore, it would be most advantageous to provide a chronometer which overcame the problems of multiple time zones and assisted in eliminating confusion regarding international timing.

Universal time co-ordinate systems which can be used anywhere and are an exact reference to a point in time wherever a user is located have been suggested in the past. A "time" in a universal time co-ordinate system cannot be repeated or mistaken for any other period of time regardless of the position on earth. For example, Greenwich Mean Time (GMT) and UTC (Co-ordinated Universal Time, based on GMT) are in widespread use. Such systems invariably follow a time base according to the Gregorian system of days, hours, minutes and seconds.

There are, however, many reasons for using a metric time base in which the day is divided decimally into, for example, one thousand "units", the year is divided into 365 (or 366 days) and the date and time could be displayed, for example, in the following format:

YEAR	DAY	TIME	FRACTION OF TIME
1997	223	753	125

This can be displayed, for example, as 1997/223/753/125 or 1997223753125 or 1997 223 753 125 or in any other format where it can be interpreted as a universal time. The figure above represents a moment in time which is smaller than nine hundredths of a second. It is unique and would not be repeated for another 10 000 years.

Such a metric time base can also take its datum from a universal time co-ordinate system such as UTC.

For the avoidance of doubt, throughout the present specification, the expression "time base" is used to refer to the duration of the basic time interval being used for counting (eg. second, or one-thousandth of a day); the expression "time co-ordinate system" is used to refer to the origin (datum) or zero point of the time units being counted (eg. where midnight falls) and the units of measure therefrom; and "universal time co-ordinate system" refers to a time measurement system in which the datum and value is common throughout the world eg. UTC.

In the metric system described above, the time field can be the same length of time as a day (24 hours). It is divided in to 1000 units, where each unit is the equivalent of 86.4 seconds. The time field is in base 10 and has a unit column, a tens column and a hundreds column. The day field is the same as the time field but when it totals 366 it increments the year field by one and resets to one. In a leap year the field reaches 367 before incrementing the year field and resetting to one. The year field has four columns in base ten, units, tens of units, hundreds of units and thousands of units. It can also have three columns instead of four, units, tens of units and hundreds of units.

To simplify the display of metric time it can be displayed in any format such as:

U997 223 753 or U223 753

Both displays can have a "U" prefix to indicate that the figure relates to a universal metric time base, although this is not essential. The moment in time is the same, the person reading the display would merely have to assume that it was the second millennium and when using the second display they would have to assume the year.

A thirteen digit number represents a period in time that is shorter than nine hundredths of a second and cannot be repeated in 10,000 years. A nine digit number represents a length of time that is the equivalent of 1.44 minutes and cannot be repeated in 10,000 years.

Days can be shown as a number and so do not have any names or religious connections. By displaying a day number in a year, confusion over different numeric formats of day:month:year / month:day:year is avoided. Standard symbols such as FR to indicate day of the week could be used with a day number.

A conventional digital clock has four columns: minutes, tens of minutes, hours and tens of hours. Most people only use minutes in base 5, that is to say they will use "ten past, twenty past, quarter to, half past". Minutes are only used to measure and state time more precisely. The metric time field has three columns: units, tens and hundreds. One unit is the same length of time as 1.44 minutes. This means that although the time field only uses three columns it is still accurate enough

for general time keeping. By using three fields it is more economical to display and use.

The precision available by extending the number of decimal places to metric time facilitates its use to computer systems logging transactions.

A fundamental drawback to a universal time co-ordinate system using a metric time base is acceptance and comprehension by the general public. Conventional Gregorian calendar and time measurement systems are in such widespread use that a Universal Metric system might never be accepted for general use, and could cause great confusion.

The present invention seeks to make it possible for persons to work to scheduled or timed events for which it is desirable to use an alternative time base to the present systems, which is based on a universal time co-ordinate system.

According to one aspect, the present invention provides a chronometer that can display two different times each having a different time base. By "time base", we refer to a fundamental unit of time measurement such as the *second* (which we shall refer to as the conventional time base) as well as one which does not use the *second*, eg. a metric-based system in which the fundamental unit is one thousandth of a day.

According to a further aspect, the present invention provides a chronometer having an oscillator from which two separate base units of time are derived for time keeping in two different time systems.

According to a further aspect, the present invention provides a chronometer having a first display mode in which a first time value is displayed and a second display mode in which a corresponding time value in a different time co-ordinate system and different time base is displayed.

According to a further aspect, the present invention provides a chronometer having a first time-keeping mode in which a first time count is maintained and a second time-keeping mode in which a corresponding time count, in a different time base from said first time-keeping mode, is maintained.

Embodiments of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 shows a block diagram of a conventional quartz watch; and

Figure 2 shows a block diagram of a watch modified according to the present invention.

With reference to figures 1 and 2, a preferred embodiment of the invention in the form of a digital watch will now be described.

The basic components of a conventional digital watch are shown in figure 1 as comprising a quartz crystal oscillator 10, and an electronic circuit 11 for providing control of the crystal oscillator and for providing time-keeping functions based on the output from the quartz crystal oscillator 10. The electronic circuit 11 is coupled to a display output 13 which may be of any conventional type, for example, LED, LCD or

analogue output. A power supply 12 provides power to all components. Typically, the quartz crystal oscillates at 32,768 Hz. This can be converted by appropriate divide circuitry in the circuit 11 in a conventional manner to an appropriate time base count, such as seconds. The time base counts are then counted and stored by an appropriate counter in the circuit 11.

In known manner, the circuit 11 provides a number of flip-flop circuits to successively divide the oscillation frequency down to the appropriate time base unit.

According to a preferred embodiment and as shown in figure 2, a watch 5 according to the present invention provides a quartz control oscillator 10 and a control circuit 15, and divide circuitry 20 comprising two divide circuits 21, 22 each producing an output at the appropriate frequency for a dual time base watch, eg. a 1 Hz output for a first, conventional, time base and a 1.15 Hz output for one-hundredth of a base unit according to a metric system described above.

The divide circuit 20 may include a common division element 23 which reduces the quartz oscillator frequency down to an intermediate frequency which is then further divided by respective divide circuitry 21, 22.

The respective outputs of the divide circuits 21, 22 are supplied to respective counters 30, 31 which act as time-keeping circuits for the respective time bases in a manner which is well known in the art.

Each counter preferably includes storage for the current date as well as the current time in its respective time base and time co-ordinate system. In the preferred embodiment, the metric time base is linked to the UTC universal time co-ordinate, which means that in certain time zones, the date as well as the time may be different according to the two counters at certain times of day.

In the preferred embodiment, the output of one of the time-keeper circuits 30, 31 is selected for output on a conventional display module 13 by way of a multiplexing circuit 40 which receives inputs 41, 42 from both counters 30, 31. The time base for display is selected by way of select line 43.

It will be understood that the multiplexer 40 may be omitted if both conventional time and metric time are to be displayed simultaneously on a dual display. The multiplexer may also be arranged to automatically alternate between displaying time in the first time base and the second time base.

Preferably, the watch also includes an indicator for showing which time base and/or time zone is currently being displayed.

Preferably, the watch also includes a conversion function provided by computation circuitry 50. A user may provide as input to the computation circuitry 50 a specified time in either the first or second time bases, via input device 52. The converted time is provided as output to the display device 13 via an output line 53 to the multiplexer 40 and by appropriate control of the select line 43.

Using this conversion function, a user may readily enter a time in one co-ordinate system and time base and have the corresponding time in the other time base and co-ordinate system displayed for easy reference.

The chronometer may be set by the user or incorporate a receiver for receiving time signals from various transmitters throughout the world to adjust the absolute values of the time keeping circuitry at appropriate intervals, as known in the art.

The chronometer may include an offset generator in the conventional time keeping circuitry 30 to increment or decrement the time by a predetermined offset to obtain a local time zone, as required by the user. Typically this offset is a whole number of hours for most local time zones but can also include fractions of hours, in known manner.

Although the chronometer of the present invention has been described in the context of a device providing separate divide circuitry 21, 22 and corresponding time keeping circuitry 30, 31, it will be understood that a single divide circuit and counter could be used, the alternative time base display being continuously generated in real time by computation circuitry 50.

The chronometer may also include a stop watch function adapted to display a count-up or count-down time in both the conventional time base and in the alternative, eg. metric time base.

The chronometer may also include an alarm function settable to a predetermined alarm time in the conventional time base and time co-

ordinate system or in the alternative time base and time co-ordinate system.

CLAIMS

1. A chronometer having a first display mode in which a first time value is displayed and a second display mode in which a corresponding time value in a different time co-ordinate system and different time base is displayed.

2. A chronometer according to claim 1 including a display adapted to sequentially or simultaneously display a current time value in both said first display mode and said second display mode, derived respectively from a common time-keeping oscillator.

3. A chronometer according to claim 2 in which the time base of said first display mode includes hours, minutes and seconds and the time base of the second display mode is metric.

4. A chronometer according to claim 3 in which the metric time base comprises one thousand units per calendar day.

5. A chronometer according to claim 4 in which the display of the time value in the metric time base includes a display one or more of tenths of a unit, hundredths of a unit or thousandths of a unit.

6. A chronometer according to claim 1 or claim 2 in which the first display mode is adapted to display a time value in any one of twenty-four conventional international time zones which time value corresponds to the time value of the second time display mode.

7. A chronometer according to claim 3 or claim 4 further including means for displaying a current date in said first display mode using day of the month and month of the year and in the second display mode using day of the year.

8. A chronometer according to claim 7 further including means for displaying a current day of the week in said first display mode.

9. A chronometer according to any preceding claim further including input means for inputting a predetermined time value corresponding to one of said display modes and for automatically displaying the corresponding equivalent time value in the other display mode.

10. A chronometer according to claim 9 further including means for selecting which of twenty-four conventional international time zones should be used in the first time display mode.

11. A chronometer according to any preceding claim further including a stop watch function adapted to display a count-up or count-down time value in both said first and second display modes.

12. A chronometer according to any preceding claim further including an alarm function settable to a predetermined alarm time value in a time base and time co-ordinate system according to the first display mode or the second display mode.

13. A chronometer having a first time-keeping mode in which a first time count is maintained and a second time-keeping mode in which a

corresponding time count, in a different time co-ordinate system and a different time base from said first time-keeping mode, is maintained.

14. A chronometer according to claim 13 further including an output and display control device for determining which of, and how, the two time counts maintained in the first and second time keeping modes are displayed on a display device.

15. A chronometer substantially as described herein and with reference to the accompanying figure 2.

Construction of digital quartz watch

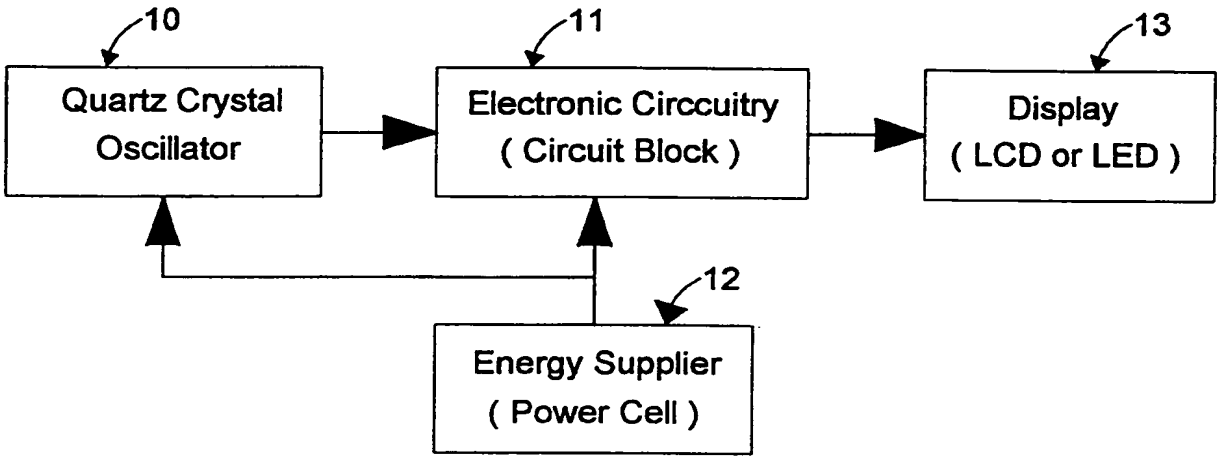


Figure 1

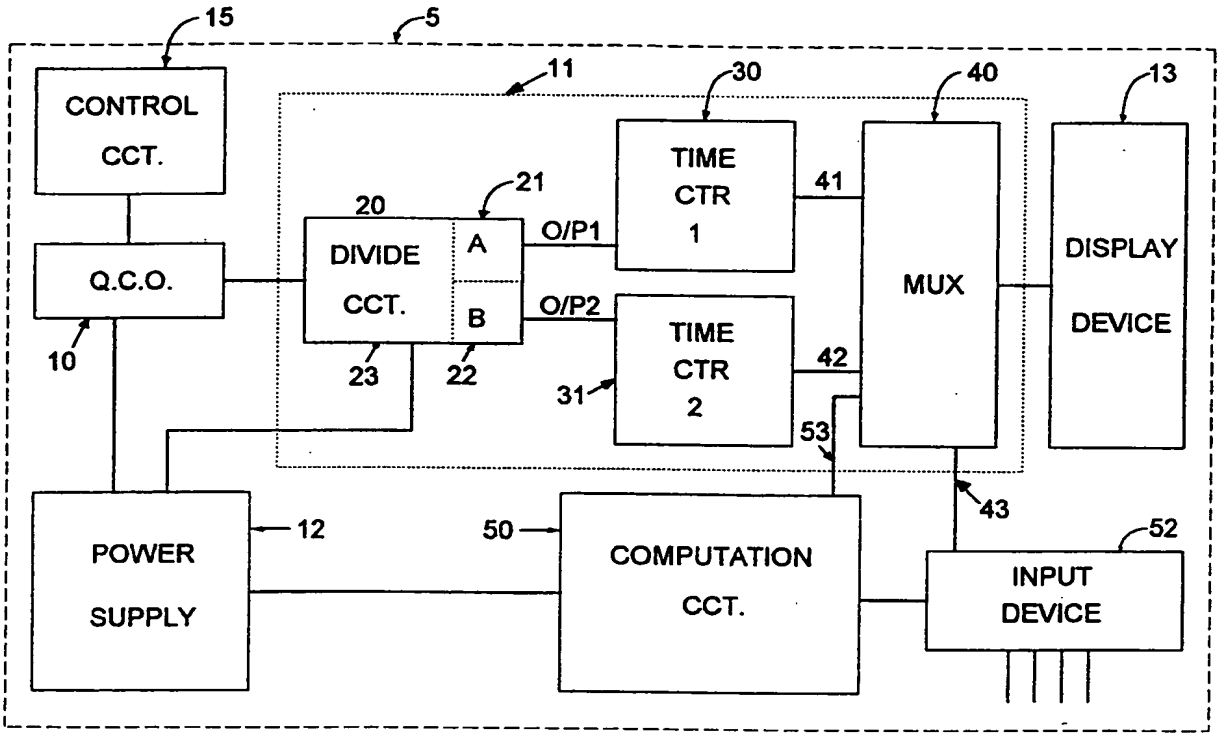

15
5
11
30
40
13
CONTROL CCT.
TIME CTR 1
41
DISPLAY DEVICE
20
21
DIVIDE CCT.
A
B
O/P1
O/P2
Q.C.O.
MUX
10
23
22
31
TIME CTR 2
42
53
43
POWER SUPPLY
12
50
COMPUTATION CCT.
52
INPUT DEVICE

Figure 2

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/GB 99/00213

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G04G1/00 G04G9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G04G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 926 400 A (RACHOFSKY MORTON ET AL) 15 May 1990	1,2,9,15
Y	see column 4, line 59 - column 6, line 35	3-5
Y	RAJA RAO T.: "Tome and Its Units" JOURNAL OF THE INSTITUTION OF ENGINEERS (INDIA) INDUSTRIAL DEVELOPMENT AND GENERAL ENINEERING , vol. 54, pt.1, September 1973, pages 25-28, XP002101432 india see page 25, left-hand column, paragraph 1 - page 26, right-hand column, paragraph 1	3-5
A	EP 0 457 032 A (BRAUN AG) 21 November 1991 see claims 1-10	1-15

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 April 1999	12/05/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Exelmans, U

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/GB 99/00213

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 444 674 A (SELLIE CLIFFORD N) 22 August 1995 see column 1, line 11 - column 3, line 59	11,13
A	US 4 185 452 A (IKEDA ARIHIKO) 29 January 1980 see column 1, line 48 - column 2, line 5	1-15
A	FR 2 391 508 A (VERGER MAURICE) 15 December 1978 see page 2, column 34-39	1-15
A	US 3 117 412 A (H. M. MALONE) 14 January 1964 see figures 1-9	1

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte Ional Application No
PCT/GB 99/00213

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4926400 A	15-05-1990	NONE	
EP 0457032 A	21-11-1991	DE 4015948 A	21-11-1991
US 5444674 A	22-08-1995	NONE	
US 4185452 A	29-01-1980	NONE	
FR 2391508 A	15-12-1978	NONE	
US 3117412 A	14-01-1964	NONE	